# LITTLE HOOVER COMMISSION
# Hearing on California Climate Change Adaptation Strategies

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### SECTION ONE: Climate Picture of Southern California

On September 27, 2010, a high-pressure weather system was parked over Southern California.[2] It drenched Los Angeles in heat from the adjacent deserts[3], while blocking the cool air over the Pacific Ocean from bathing the city in the temperate climate that produces 300 days of sunshine a year and a year-round average high temperature of 70°. At the University of Southern California, near downtown, a weather station recorded 113° Fahrenheit—a new record for the city. Then the thermometer broke.

Southern California is famous for its weather. Early civic boosters promised an English silviculture in a Mediterranean climate, and although early film studios had located in New York City and the Bay Area, the balmy climate motivated them to relocate to LA, where movies could be filmed year-round. People across the country watched the movies and heard the call, doubling metropolitan LA's population between 1930 and 1950, and again between 1950 and 1985.[4]

It increasingly looks like that weather is as much a relic of the 20th century as silent film, though. A study of the future climate of Los Angeles by UCLA professor Alex Hall, who serves on the UN's Intergovernmental Panel on Climate Change, analyzed data from 30 global climate models and "downscaled" their findings to a much higher resolution to predict likely temperature changes by mid-century in each of the city's microclimates—ocean, urban, mountain and desert.

Each is expected to experience average temperature increases of three-to-five degrees by 2050. That may not sound like much—what's the difference between 73° and 78°, after all?—but the difference between a momentary reading and a yearly average is profound. An average increase

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[1] The essay is from a yet-to-be published work by Jonathan Parfrey and New York Times writer Paul Tullis.
[2] http://usatoday30.usatoday.com/weather/news/extremes/2010-09-27-california-heat_N.htm
[3] http://www.accuweather.com/en/weather-news/its-official-hottest-day-ever/37923
[4] http://cgge.aag.org/PopulationandNaturalResources1e/CS_US_July09/CS_US_July094.html

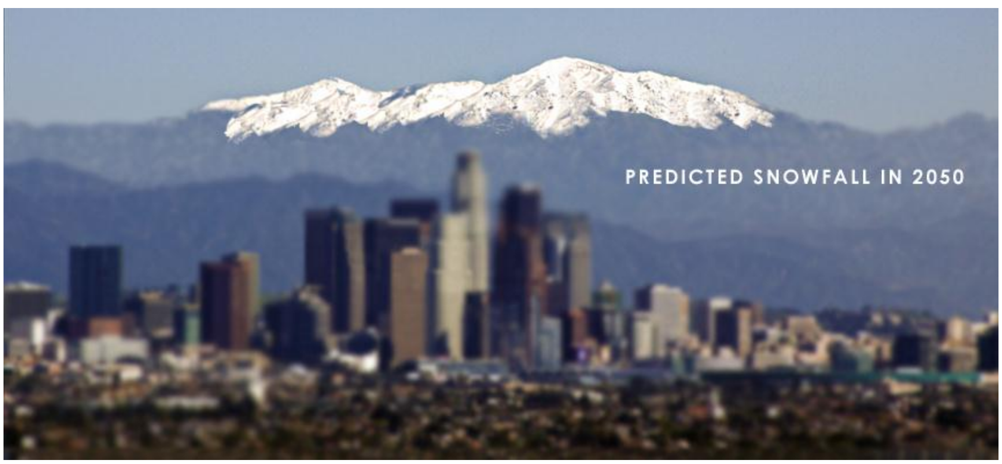
means a rightward shift caused by many more days at the extreme high end of the scale, and that's exactly what Hall and colleagues found: There will be three-to-six times as many days when temperatures around Los Angeles exceed 95°F. Areas that today experience extreme heat eight days a year will likely see more than a month of such weather. Studio City, meet Palm Springs.

These changes will have tangible effects on public health and the economy. More incidents of heat stroke and heat exhaustion will be the most direct. Heat converts nitric oxide and nitrogen dioxide, which are common components of air pollution caused by cars, to ozone; this will affect the pulmonary health of everyone, from infants at a critical stage of lung development to the elderly and infirm. Vector-borne diseases associated with heat, such as Saint Louis encephalitis and murine typhus, will be more common. All of this will result in higher health care costs to individuals and the public and private sectors, and lost workdays and earlier deaths dragging on the economy.

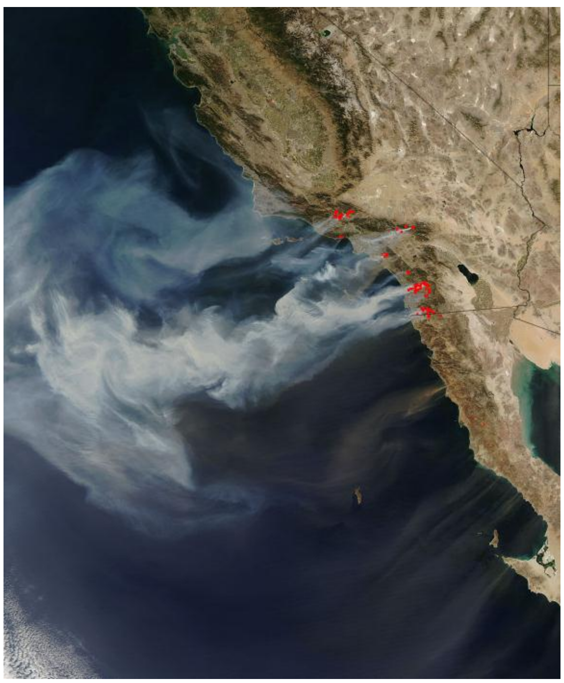
Los Angeles has, over the last several years, become a leader among large cities in committing to reduce its contribution to global warming and shift to cleaner sources of energy in the future (more on this below). Ironically, though, even as electricity generation has been a major contributor to greenhouse gas emissions causing the rise in temperature, the rise in temperature will place new demand for electricity generation. Air conditioning and refrigeration, which are the largest draws on electricity in most homes and businesses, will be needed even more with higher temperatures.

One of the iconic images of Los Angeles is a photograph taken from southwest of downtown, with the skyscrapers foregrounding snow-capped peaks of the San Gabriel Mountains, the third-steepest range in North America. (The shot is aided by the use of a telephoto lens, which flattens images to make backgrounds appear closer to the objects in front, as well as by the fact that storms like those that drop snow on the San Gabriels wash the Los Angeles basin of the smog that typically obscures them from view somewhat.)

In mid-century L.A., though, that's going to be a tougher shot to capture: Hall forecasts thirty-to-forty percent reduction in the amount of snowfall in the Los Angeles region, depending on whether we choose to make significant reductions in greenhouse gas emissions or not. This will mean more than just diminished income for manufacturers of postcards: recreational opportunities, which have economic impact, will be reduced, as weekend migrations to the mountains by the thousands will be fewer and farther between.




Of greater consequence will be the effect of reduced snowpack as a result of warming outside the immediate area. Snow acts as a natural reservoir for water across the entire southwest, storing it at higher elevations through the winter, then releasing it gently during the drier summer months into rivers and aqueducts that carry it to cities from Denver to San Diego. With only 15 inches of rain per year falling on Los Angeles itself, the city has for nearly a century imported most of its water. All the imports come from sources fed by snowmelt. But as more mountain precipitation falls as rain, which soaks into the water table for use locally, less will be available for export. The contracts that divide Colorado River water, where LA gets a third to a half of its water, depending on the year and the season, were based on data from a few years that we now know enjoyed exceptionally high rain and snowfall; the river now delivers less water most years than is promised to all the cities, towns and farms that rely on it throughout its course from the Rocky Mountains to the Gulf of California. That situation will probably get worse before it gets better for any prolonged duration: global climate models indicate the Rocky Mountains will experience more drought in the future, potentially even centuries-long “megadroughts” which we know from tree ring research at the University of Arizona have struck the region in the past. Moreover, with snowmelt becoming increasingly concentrated into a few weeks in the spring instead of drawn out into July, and local precipitation potentially happening in intense bursts like the “atmospheric river” that parked over the Bay Area in 1994, delivering 27 days of rain in January, the infrastructure to capture those flows was built for a climate that doesn’t exist anymore.



One of the less savory elements of Southern California climate is the yearly occurrence of Santa Ana winds. Hot, dry air over the Great Basin east of Los Angeles is drawn by osmosis toward cooler air over the ocean; the desert air channels into valleys and mountain passes, accelerating sometimes to hurricane force. The Santa Anas often form in the autumn, when the region is at its driest as it waits for the commencement of the winter rains, which usually begin in the middle of November. They therefore often exacerbate wildfires, as in October 2003 when 15 wildfires, including perhaps the largest in the state’s history, burned more than half a million acres, destroyed 4,000 homes and killed scores of people. Wildfire burns more rapidly upslope, since heat rises; when Santa Ana winds blow from the opposite direction, the fires can grow in size and intensity in every direction, becoming dangerously unpredictable.

The good news, if it can be called that, is that as the city warms, there will be less contrast between Los Angeles’s weather and the desert’s, and so fewer Santa Ana wind events. The bad news is that this will have little effect on the fire regime—the interval of return and typical severity of wildfires—in Southern California. This is because of what scientists describe to laypeople as the atmosphere's "sponginess": As the temperature rises, the air wants to absorb more moisture from the ground. That makes less water available for trees. And drier trees ignite more easily, and burn more intensely.

At the other end of the city, the ocean is continuing its inexorable advance on the shore: Three thousand beachfront homes were lost to major storms in the 1980s, and storms like these are predicted to become more frequent. The longest continuous record of sea level in North America, at Fort Point in San Francisco, shows a steady march of around eight inches over the last 100 years; the global mean sea level has risen over the last two decades at twice the rate of the preceding eight. If this trend continues, and there's no reason to believe that it won't, there is a one in six chance that 10,000 people in Huntington Beach will see their homes flooded by 2020. Meanwhile, the anachronistically named Broad Beach in Malibu is getting narrower and narrower. If the history of government aid to rebuild after "natural" disasters such as Hurricane Sandy, Mississippi River floods and the Panorama fire that burned 284 homes in San Bernardino in 1980 is any indication, though, wealthy residents of these areas will likely see their homes rebuilt with taxpayer funds. They aren't the only ones losing their homes, though: ocean acidification and rising sea temperatures will cause major losses of sea life in the kelp beds and marine protected areas off the California coast.

**SECTION TWO: What the LA-Area Can Do About Climate Change**

The litany is long, the changes are inexorable, much of it is getting worse. Yet, there is a great deal that can be done to mitigate and adapt to the changes that are coming to Los Angeles.

Much of the heat in the city—up to forty degrees, depending on the area—is attributable to the **urban heat island effect**: pavement and rooftops absorbing infrared energy. With an incredible forty percent of LA's land mass covered by asphalt, the city can reduce its temperature to below the projected effects from climate change with entirely passive technologies. Cool roofs, which can be applied to any existing roof without replacing it, reflect energy back into the atmosphere—reducing heat at ground level and the need for air conditioning inside the building. Cool pavements, which can have ancillary benefits such as reducing stormwater runoff and improving groundwater collection, do the same thing, and on school playgrounds in the San Fernando Valley where the basketball court can reach 150ºF in the early days of the school year, that's a big deal. Fabric shade barriers over sidewalks can further reduce the urban heat island effect, as would planting trees, which of course have the additional benefit of absorbing carbon dioxide. These cost-effective adaptations and mitigations protect public health, sequester greenhouse gasses reduce electric bills.

As the **water supply** becomes more critical because of pressure on imports, there is much the city can do to reduce demand in the city while increase the portion of water used in Los Angeles that's locally generated. As temperatures rise, demand for water will correspondingly rise. To keep Angelenos cool in the summer and keep roses pink demand is projected to rise by at least 5% by mid-century. As much as half of summer water use in L.A. is used outdoors, for landscaping and swimming pools. The municipal utility, the Los Angeles Department of Water and Power, will pay customers to replace thirsty grass lawns with drought-tolerant flora, and aggressive price signals to customers using more water than is reasonably needed in a household could make swimming pools more of a luxury.

When it rains in L.A., 80 percent of the water goes into the ocean. That's actually by design: Floods in the city's early days motivated urban planners to turn its rivers into concrete channels designed to remove rainwater from the city. But today's planners understand that rain is too valuable to be disposed of; the Tujunga watershed restoration project is a prime example of the kind of infrastructure investments the city will need to undertake to secure water for the future. A portion of the water is now diverted from the concrete channel upstream of the restoration site and allowed to flow through a renewed landscape of native riparian habitat planted beside the channel, where gravel and weeds used to dominate. Up to 118 million gallons of water are thus infiltrated down to the groundwater, where it is naturally filtered and available for later use. Greening the map further, the whole thing is now a park, providing recreational opportunities for the surrounding community while also cleaning the air. Channels like the Tujunga exist throughout Los Angeles County. The biggest, of course, is the L.A. River; advocates for years have been working toward freeing the river from its channels and letting it return to a more natural state. Potions of the river, where groundwater seeping up from springs would have ruined any concrete bed, including a stretch beside Los Feliz and Atwater Village that splits the Interstate 5 freeway and a recycled-metals facility, retained the natural bottom, and with the need for increased conservation acknowledged in the Los Angeles River Master Plan, undertaken by the Department of Public Works at the behest of the County Supervisors, the prospect of more restoration projects alongside—or replacing—the concrete channels of the 20th century seems reasonable if not inevitable. The 350 million gallons of waste water now dumped into Santa Monica Bay at the Hyperion Water Treatment facility is another potential resource, with water recycling technologies now capable of producing the cleanest water available anywhere, and stormwater capture at a smaller scale, spread widely, can have significant effects; schools, churches and green builders are already discovering the benefits of stormwater capture and groundwater recharge.

Electricity is essential in keeping a city cool and climate resilient. The Chicago heat wave of 1995 made America brutally aware of the importance of air-conditioning. The 750-plus deaths were largely attributable to people lacking electricity to power air-conditioners.

Yet there are direct climate threats to **electrical generation** in California. According to Lawrence Berkeley National Lab, climate change will result in a need for 39% more capacity (17.2 gigawatts) by end of century. The state's transmission lines are vulnerable as they traverse thousands of miles of forest, newly vulnerable to climate-caused wildfire. Lawrence Berkeley believes there is a 40% increase in probability that wildfire will take-out major transmission lines.

However, there is a win-win solution. California's distribution and transmission grid can be modernized and hardened to be climate resilient. One answer is in local generation and storage: microgrids. During Hurricane Sandy in October 2012, the East River overflowed its banks, flooding large sections of Lower Manhattan. The lights went out except for one area. New York University was able to provide heat and power to its campus because it operated its own microgrid. Similarly, thanks to their microgrid, UC San Diego sailed through a recent power outage. Microgrids are helpful in reducing greenhouse gas emissions as they can accommodate more locally generated solar power.

Ultimately, though, Los Angeles will have a difficult time facing a climate-constrained future exclusively through adaptation; reducing greenhouse gas emissions worldwide is the most critical part of any solution. As one of the world's leading cities, which has been setting global cultural and political trends for a century—among them, for many years, fealty to personal mobility and suburbanization with little thought the long-term common good—LA is in a unique position to lead by example in the effort to reduce greenhouse gas emissions. Electricity generation and transportation are the two biggest sources of climate-forcing emissions worldwide, and LA is no exception. Beginning with its recent commitment to eliminate coal from its portfolio of electricity sources, and investing billions in public transportation, vehicle electrification and fleet modification to lower-emissions vehicles, Los Angeles is already incentivizing energy efficiency while supporting the transition to a renewable energy future.